Part III – RESPONSIVENESS SUMMARY

12. BACKGROUND ON COMMUNITY INVOLVEMENT

Comments and questions received during the public comment period are summarized in the first section of this responsiveness summary. The comments were grouped according to the topics they focused on, and were then summarized into succinct statements in order to capture the significant issue discussed, or information requested. The purpose is to provide, as required by U.S. Environmental Protection Agency (EPA) guidelines for Responsiveness Summaries, as documented in *Guidance on Preparing Superfund Decision Documents* (EPA 1999c [EPA 540-R-98-031, OSWER Directive 9200.1-23P]):

- A clear and concise measure of which aspects or elements of the alternative the community supports, opposes, or has reservations about

- General concerns about the sites being remediated under this action, and the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) process at those sites.

The objective of the responsiveness summary is to provide for the community and for Agency decision-makers a synopsis of community preferences and concerns, and Agency responses. Although the summarized statements rephrase for brevity the comments submitted, they in no way replace them and are not intended to alter their focus. Bracketed numbers at the end of each summarized topic statement identify the original comment or comments. The complete original comments can be referred to in Appendix A for the discussions or questions from which the summaries of significant concerns were condensed.

All comments that were received are presented in Appendix A, either as scanned written submissions or as transcripts of the formal comments made at each public meeting. Each document is annotated to indicate the comments used to prepare the Responsiveness Summary. The documents are numbered separately in two series: comments in response to the Proposed Plan (W1 through W7) and comments transcribed during the formal comment sessions of the public meetings (T1 through T3). Indexes at the beginning of Appendix A list the comments by commenter, by response number, and by topic.

The responsiveness summary begins with questions and comments on the community relations process for the remediation of Operable Unit (OU) 1-07B (see Section 3 for the history of community participation in this action). Next are questions and comments concerning the treatability studies and the activities carried out during this process. Finally, questions and comments are presented that focus on the remedial actions proposed under this Record of Decision (ROD) Amendment. In this manner, topics follow an order paralleling their presentation in the Proposed Plan. A total of 28 topics are identified in this summary.

Sections 7.1.3 and 7.2.3 summarize how the community's issues and concerns were incorporated into the evaluation of alternatives for this action. Section 11, References, includes all documents referenced in the Responsiveness Summary.

13. STAKEHOLDER ISSUES AND AGENCY RESPONSES

The following sections detail the topics of concern to the community, as raised during the public comment period, and the Agencies' responses.

13.1 Overall Goals of the INEEL Environmental Restoration Program

1. **Topic:** A commenting group wrote that the new remedy presented in the Proposed Plan is both economically and environmentally preferable to current reliance solely on pump-and-treat. The group called this a successful demonstration of the value of investing in research and development. They recommend that the process used here to identify and demonstrate emerging technologies with potential merit be used as a model for future efforts. [W7-2]

   The same commenting group wrote elsewhere that they were particularly pleased with the timely incorporation of an emerging technology into the Idaho National Engineering and Environmental Laboratory's (INEEL's) cleanup program. They expressed the hope that the U.S. Department of Energy (DOE) will continue to monitor emerging technologies and consider using any that appear promising. In particular, the group wrote, they are interested in emerging technologies that would reduce overall cleanup costs and/or enhance environmental protection. [W7-6]

   Response: The Agencies are pleased that members of the public have noted and applauded the INEEL's efforts to find, develop, and implement innovative technologies for cleanup, whenever they are appropriate and cost-effective. In this, the Agencies follow CERCLA guidance (40 CFR 300.430) to ensure that innovative treatment technologies are examined if they offer the potential for equal or better performance or implementability, fewer or less adverse impacts, or lower costs in comparison to demonstrated treatment technologies.

13.2 Public Participation and Community Relations

2. **Topic:** Several commenters asked for an extension of the comment period. One commenter stated that a comment period that starts the day after Thanksgiving and ends the day after Christmas is not a 30-day comment period. [T2-1, W7-1]

   Response: The comment period for the Proposed Plan was extended in response to public requests for additional time to participate in the decision-making process. The original comment period was exactly 30 days, as is required for CERCLA actions. However, the Agencies recognized that the end-of-year holidays are a busy season, which may not allow people the time they would like for review and comment. At the same time, the Agencies did not wish to delay the project, so they chose instead to release the Proposed Plan in late November when it was ready, and extend the comment period to give everyone ample time to respond without adversely affecting the project schedule.

3. **Topic:** DOE should try to schedule public meetings so that they do not conflict with other public meetings, such as the one on the same date (December 5, 2000) in Jackson, Wyoming. DOE should try to schedule public meetings at different times. [T2-2]

   Response: The Agencies were aware that the first public meeting for the OU 1-07B Proposed Plan took place in Idaho Falls on the same night that a public meeting for an unrelated INEEL project took place in Jackson, Wyoming. However, a second public meeting for the OU 1-07B Proposed Plan was held the following night in Twin Falls, approximately the same driving time from Idaho

Falls as Jackson, Wyoming. Admittedly, members of the public and the media who wished to attend meetings on both projects had to attend two meetings in the same week. However, the Agencies were equally aware that with the busy holiday season coming up, the only alternative was to delay the OU 1-07B meetings and, consequently, the project. Public meetings on proposed plans are intentionally scheduled one week after the beginning of the public comment period to allow the public sufficient time following the meeting to submit their comments before the comment period ends.

13.3 Content and Organization of the Proposed Plan

4. **Topic:** Several commenters requested more information be included in the Proposed Plan, such as the location of the monitoring wells, statistical and study data, the vertical distribution of the plume, and construction details about the injection well. [T3-1, W3-1] Another commenter questioned the data presented in the Proposed Plan, especially in relation to the 1995 Record of Decision. The commenter felt that facts about radionuclide contamination were omitted or concealed. [W5-1, W5-17, W5-18]

Response: The Agencies appreciate all suggestions from the public on types of information that could help a Proposed Plan better serve its purpose. The EPA's CERCLA guidelines define a proposed plan's content and purpose (see 40 CFR 300.430 and *Guidance on Preparing Superfund Decision Documents,* EPA 540-R-98-031, OSWER Directive 9200.1-23P [EPA 1999c]; the Guidance is available on-line at http://www.epa.gov/superfund/). The proposed plan is a summary only, containing information required for the public to review the alternatives and preferences under consideration. The proposed plan, under CERCLA guidelines, supplements and is based on the comprehensive 1994 Remedial Investigation and Feasibility Study (RI/FS) (EG&G 1994 [EGG-ER-10643]), "but is not a substitute for that document." In this case, the Proposed Plan was based on the comprehensive RI/FS and the Field Demonstration Report (DOE-ID 2000 [DOE/ID-10718]).

The EPA's CERCLA guidance intends the proposed plan to provide a "brief summary description" of: (1) the remedial alternatives evaluated, (2) the alternative that is preferred, and (3) the information that supports the selection of the preferred alternative. Other sections of the Proposed Plan (the history and nature of site contamination including identification of contaminants of concern [COCs], previous actions, and risk assessment) are included as background information for the convenience of readers.

For readers who seek more information on any aspect of the investigation process, the Proposed Plan provided references to documents in the Administrative Record that present in full the information cited. The complete details of the OU 1-07B investigation, including sampling data, maximum contaminant levels (MCLs), and well construction details, can be found in the 1994 RI/FS, the Field Demonstration Report, and other OU 1-07B documents in the Administrative Record (see Section 2.5 in this ROD Amendment for a complete list of key documents).

Details regarding radionuclide COCs can likewise be found in the 1994 RI/FS and other OU 1-07B documents in the Administrative Record. However, as stated in Part I, Declaration, of this ROD Amendment:

> "The primary risk driver for OU 1-07B has been determined to be the ingestion of groundwater contaminated with the volatile organic compound (VOC) trichloroethene (TCE). The other VOC contaminants of concern (COCs) – tetrachloroethene [PCE] and cis-1,2- and trans-1,2-dichloroethenes (DCE) – are less widespread in the contaminant

plume than TCE. Also present are four radionuclides –Cs-137, Sr-90, tritium, and U-234 – that have been included as COCs because they exceed EPA risk-based concentrations for groundwater ingestion. TCE and PCE are the only two COCs consistently detected in the production wells at levels exceeding federal drinking water standards (maximum contaminant limits [MCLs])."

Risk assessment methods can only be summarized in the Proposed Plan, but are always described in detail, as required, in the RI/FS on which the plan is based.

Further details will be developed during the remedial design/remedial action phase of this project.

5. **Topic:** One commenting group commended the Agencies for a well-written, well-organized, and nicely formatted Proposed Plan. [W7-5] Another commenter asked that the Proposed Plan be withdrawn and reissued to include facts about radionuclide contamination. [W5-1, W5-17, W5-18]

   Response: The Agencies appreciate the commenting group's compliment. Many of the improvements made in the INEEL's proposed plans have been made in response to readers' requests.The Agencies will continue to respond to specific areas of concern identified by the public in INEEL proposed plans released in the future.

   The EPA's CERCLA guidance intends the proposed plan to be a "brief summary description." Thus, all details of an investigation cannot be included. However, the Agencies make every effort to clearly and completely identify all issues that may be of concern to the public.

   Four radionuclides were identified as COCs and those COCs exceed EPA risk-based concentrations for groundwater ingestion. Radionuclides in most of the medial zone and in all of the distal zone are below MCLs already. Radionuclides in the hot spot are not expected to migrate more than several hundred feet. Institutional controls are already in place to protect workers at the INEEL and the environment. The institutional controls will be maintained until the plume is restored and drinking water drawn from the plume area is safe for use. For these reasons, the proposed plan was deemed to be adequate and was not withdrawn and reissued.

6. **Topic:** The Proposed Plan is inaccurate and erroneous and the Agencies know this, but the Agencies expect that the public will fail to understand the proposed actions or will be tired of the futility of voicing their opinion. [W5-1]

   Response: The Proposed Plan is based on documents in the Administrative Record. Every effort is made to ensure that the content of the Proposed Plan summarizes the RI/FS accurately, and that it is written in clear English that is as understandable as possible to the public. The Agencies' commitment to meeting the public's expectations for clear yet comprehensive content has led within the past few years to convening a statewide focus group to critique proposed plan format and content and on one occasion complete reissue of a proposed plan in response to public request. The Agencies believe that the detailed comments received in writing and at public meetings show that, on the whole, Idahoans have a good comprehension of the INEEL's proposed plans and continue to be willing to participate in the CERCLA public involvement process at the INEEL. The Agencies appreciate the public's willingness to consistently participate in involvement activities. All comments submitted by the public during the comment period are addressed in this responsiveness summary and were considered during the Agencies' selection of a final remedy.

13.4 OU 1-07B Remediation Planning and Costs

7. **Topic:** Previous OU 1-07B documents have stated that there is no "cost-effective" treatment for radionuclides. The commenter questioned this, and stated that DOE cost estimates are grossly inflated. [W5-4]

Response: Cost-effectiveness for treatment of radionuclides at OU 1-07B is determined in accordance with CERCLA *Guidance on Preparing Superfund Decision Documents* (EPA 1999c). A remedy is considered cost-effective if its costs are proportional to its overall effectiveness (40 CFR 300.430). The original 1995 ROD (DOE-ID 1995 [DOE/ID-10139]) called for extensive studies to determine whether radionuclides could be removed from the Test Area North (TAN) groundwater brought to the surface, and if so, at what cost.

A radionuclide removal study was performed in 1996. The overall objective of the radionuclide removal study was to determine, for groundwater extracted for 1,3-trichloroethene (TCE) remediation, whether there was a cost-effective method to remove radionuclides so that it could meet maximum contaminant levels (MCLs) for the two radionuclides of concern, strontium-90 and cesium-137, before reinjection. Tests were performed to evaluate the effectiveness of five reverse-osmosis membranes and five ion-exchange materials. These technologies were selected as the most promising of the technologies that are currently commercially available. Although the reverse-osmosis membranes showed good separation of the radionuclides, the technology was not pursued further because of the large amount of liquid waste that would be generated.

Screening tests were performed on five ion-exchange materials. None of the five exhibited exceptional effectiveness for both strontium and cesium removal. The three most effective materials were chosen for further bench-scale testing. One showed some effectiveness for strontium-90 removal, but not for cesium-137 removal. Another had some effectiveness for cesium-137 removal, but not for strontium-90 removal. The third material was not effective and was removed from further consideration. Because of the high quantities of calcium and magnesium in the Snake River Plain Aquifer, most of the ion-exchange resin becomes loaded with calcium and magnesium instead of the desired strontium and cesium. With all three materials, the removal efficiency for cesium-137 and strontium-90 was determined to be dependent on the material's loading capacity for calcium and magnesium. The large quantity of waste that would be generated – and would require subsequent disposal as mixed low-level waste – would contain relatively large amounts of calcium and magnesium and only relatively small amounts of the radionuclides of concern.

From these studies, the Agencies' calculated that the operating cost for radionuclide removal from the contaminated groundwater using the multiple technologies that would be required for separate removal of cesium-137 and strontium-90 would be around $4.8 million annually. This would cost more than the rest of the remediation project combined. No other commercially available technology currently exists to carry out in situ radionuclide removal from groundwater containing high concentrations of cations, such as calcium and magnesium. Therefore, the Agencies determined that radionuclide removal from groundwater brought to the surface would not be cost-effective and agreed in the *Explanation of Significant Differences* (INEEL 1997 [INEEL/EXT-97-00931]) that it would not be performed.

DOE cost estimates are calculated following specific federal guidelines. In addition, Section 3.3.8 of CERCLA *Guidance on Preparing Superfund Decision Documents* (EPA 1999c) requires that the estimated costs of remedies have an expected accuracy of –30 percent to +50 percent. This range is

intentionally selected to avoid underestimates, and the consequent necessity of adjustments in funding allocations.

13.5 Risk Assessment

8. **Topic:** The Proposed Plan states that an estimated 35,000 gallons of TCE were disposed of in the Technical Support Facility (TSF) injection well. However, the 1995 Record of Decision gives an estimated range of 350 to 25,000 gallons. Which estimate is correct? Why was the estimate changed? What was the new data that led to this change? Was the original estimate based on inadequate data? [W5-2]

   Response: The historical records available provide little definitive information on the types and volumes of organic wastes disposed of into the injection well over the 20 years of its use. The original 1995 ROD (DOE-ID 1995 [DOE/ID-10139]) estimate of 350–25,000 gallons was based on limited historical data and general knowledge of activities producing this type of waste. However, the 1994 RI/FS cited an upper limit of 35,000 gallons. For the Proposed Plan and the ROD Amendment, the Agencies chose to use the higher estimate.

9. **Topic:** One commenter stated that information in Table 1 of the Proposed Plan, listing the Federal drinking water standard, erroneously leads a reader to believe that the 4 millirem per year (mr/yr) MCL is assessed for each individual radionuclide when actually it is an additive or cumulative threshold. The commenter concluded that the cumulative concentrations reported are above the levels allowed. Please identify how the actions in the Proposed Plan and ROD Amendment will meet the cumulative drinking water MCLs. [W5-3]

   Response: The Federal drinking water standards shown in Table 1 of the Proposed Plan for each of the contaminants of concern are provided solely for comparison with the contaminant ranges found in the vicinity of the TSF-05 injection well. The risk assessment process carried out for this site used the published MCL, which the commenter also cites. The remedial action selected under this ROD Amendment will meet the MCL for radionuclides of 4 mr/yr, cumulatively, within the 100-year remedial action time frame scheduled for this action. The remedial action objectives established for this activity will ensure that the entire contaminant plume will meet the cumulative drinking water MCLs by 2095 (see Section 5).

10. **Topic:** The Proposed Plan does not describe in detail how radionuclides will decline to acceptable levels by 2095. How will the proposed remedy address this? [W5-5] Specifically, Table 1 of the Proposed Plan indicates the aquifer is presently contaminated with 530–1,880 picocuries/liter (pCi/L) of strontium-90 and 1,600 pCi/L of cesium-137. Based on the half-lives, the commenter calculates that the concentrations of these radionuclides will still be above MCLs in 2095 and asks why this information was not included in the Proposed Plan or the original 1995 ROD (DOE-ID 1995 [DOE/ID-10139]). [W5-4] Further questions on this topic are: How will radionuclides be treated to meet MCLs? How will the proposed treatment meet remedial action objectives for restoration of the aquifer by 2095? What portion of the aquifer will not be remediated for radionuclides by 2095? Will radionuclides be treated so that the remedial action objectives can be achieved? [W5-4]

    In Figure 6 (on page 18), the Proposed Plan states that radionuclides in the medial zone will drop below MCLs by 2095. Why is this statement not made for radionuclide concentrations in the hot spot? [W5-16] If the preferred alternative does not treat radionuclides in the hot spot, radionuclides

will remain above MCLs for over 200 years past the 100-year treatment time frame; how does this comply with laws? [W5-17]

Another question concerns the Agencies' statement that the radionuclides will naturally sorb onto the basalt. What are the absorption coefficients? Empirically, equilibrium should have already been reached between the radionuclides in the water and those absorbed onto the basalt. [W5-5]

Response: Four radionuclides were determined to be contaminants of concern in this cleanup action: tritium, strontium-90, cesium-137, and uranium-234. Tritium and uranium-234 are currently below their respective MCLs at all locations within the contaminant plume, and concentrations of these two contaminants will continue to drop through natural decay processes.

Two contaminants, strontium-90 and cesium-137, are only above their respective MCLs near the hot spot. It is known that concentrations of these two contaminants in the groundwater (the dissolved phase) are being and will continue to be reduced through radioactive decay (as measured by standard half-life calculations) and adsorption of the radionuclides to the geological matrix through which the aquifer moves. Research data and theoretical models indicate that additional mechanisms, such as carbonate precipitation, may also operate to reduce radionuclide concentrations and will lead to a corresponding reduction in risk to future groundwater users. The Agencies expect that concentrations of these radionuclides will be below MCLs by 2095 or earlier.

Empirical evidence from monitoring data collected for over 10 years shows that both cesium-137 and strontium-90 are very strongly adsorbed in the residual source area. Radionuclide migration during the past 40 years has been very limited. Historical monitoring data reveals that concentrations of cesium-137 drop by an order of magnitude after only 25 feet of travel from the TSF-05 Injection Well, and strontium-90 concentrations drop by two orders of magnitude within 500 feet of the hot spot.

While it is true that quasi-equilibrium was probably reached in the secondary source before the initiation of remedial activities, these activities have disrupted that equilibrium. Performance monitoring data will be collected throughout the remedial action. These data will be frequently evaluated to determine whether appropriate progress is being made toward meeting the remedial action objectives. If it becomes clear that meeting the objectives is in doubt using the proposed remedy, additional remedial actions will be taken to ensure protectiveness.

CERCLA also requires that the Agencies conduct 5-year reviews to monitor the effectiveness of the remedy. As part of those reviews, the Agencies will monitor the progress of the entire Remedial Action, including radionuclide data. The INEEL plays an active part in current global research on groundwater contamination and cleanup. OU 1-07B project staff review research reported in leading scientific journals and at international symposia as it relates to the remedial action at TAN. The Agencies have actively supported and will continue to support research on environmental remediation.

11. **Topic:** One commenter stated that this is an industrial waste problem and not a radioactivity problem. [T2-3]

Response: It is both. The contaminant of concern (COC) that poses the greatest risk to future groundwater users is TCE, which is a result of industrial activities at TAN. Therefore, for the TAN injection well, TCE is the "risk driver." However, the current risks posed by strontium-90 and cesium-137 near the hot spot also are greater than acceptable levels. Both of these radionuclides will be monitored and evaluated as part of the Agency 5-year review process.

13.6 Remedial Action Objectives and Compliance with ARARs

12. **Topic:** The Proposed Plan states that the Agencies have agreed to implement the State regulation IDAPA 37.03.03.050.01 to allow injection of chemicals above MCLs. Is this a statement of intent to provide formal waivers and variances? [W5-7]

    Response: No, the Agencies do not intend to pursue waivers or variances. The Agencies have agreed that amendments containing constituents above MCLs may be injected to support aquifer remediation. The amendments being used are food-grade chemicals, which meet higher standards than industrial-grade chemicals. Moreover, the chemicals used for injection are sampled and analyzed to ensure aquifer protection, even though they are labeled as safe for human consumption.

13. **Topic:** The Proposed Plan states that the TCE in the aquifer came from a Resource Conservation and Recovery Act (RCRA) "listed" waste source. If such water is to be reinjected into the aquifer, then the listed waste code must be removed or the injection well becomes a Class IV well, which is prohibited under Idaho regulations. Please clarify whether the treated water is delisted or that it no longer contains RCRA-listed waste. [W5-9]

    Response: Because the TCE in the contaminated groundwater is a RCRA-listed waste, all components on the influent side of the treatment system, including the air stripper equipment, have been designed to meet the secondary containment requirements of 40 Code of Federal Regulations (CFR) 264 Subpart J of RCRA. After the air stripping process, the water will be determined to no-longer-contain the listed TCE waste and will be reinjected to the aquifer if it meets the remedial action objectives, remediation goals, and ARARs. The no-longer-contained-in determination is documented in the Administrative Record in correspondence among the Agencies.

14. **Topic:** The Proposed Plan states that radionuclides will not be reinjected if they are above MCLs. How will the monitoring frequency of treated water be sufficient to detect any changes in the concentration of both the TCE (and other organic chemicals) and of radionuclides? Sampling has been conducted monthly in the past; has this interval allowed violations to occur without detection? How will the Agencies ensure the treatment process is immediately halted if either chemicals or radionuclides in treated water exceed MCLs? [W5-8]

    Response: As stated in the Proposed Plan, water that is treated in the New Pump and Treat Facility (NPTF) and then reinjected into the aquifer will not contain contaminants at concentrations greater than the applicable MCLs. The NPTF effluent will be monitored to ensure that reinjected water meets state of Idaho underground injection control (UIC) requirements. Monitoring of groundwater extracted for aboveground treatment has shown that the concentrations of the contaminants of concern (COCs) have remained relatively constant, and the Agencies deem that the monitoring frequency has been adequate. Monitoring frequency and methodology will be specified after the signing of this ROD Amendment, during the remedial design process. Monitoring wells located upgradient of the NPTF will be monitored on a routine basis. This will ensure the Agencies identify groundwater with high concentrations of radionuclides before those radionuclides reach the NPTF. Air stripper systems are simple in design and operation, and have been used for many years in both the DOE complex and the private sector to treat water contaminated with volatile organic compounds (VOCs). As long as the air stripper is run with adequate airflow, the organic contaminants will be removed to below the applicable maximum contaminant levels (MCLs).

    The Agencies agreed that radionuclide treatment would not be included in the design for the NPTF because radionuclides are not expected to be present in groundwater routinely treated through the NPTF. Although it is not expected, in the event that radionuclides migrate to NPTF extraction

wells in the future, a contingency remedy for the medial zone would be implemented. This contingency remedy would involve operation of the existing Air Stripper Treatment Unit (ASTU) to extract groundwater from a well upgradient of the NPTF, treat the contaminated water in an air stripper to remove VOCs, and reinject the treated water in an injection well located near the hot spot, upgradient of the NPTF, to facilitate sorption of radionuclides onto subsurface soil and rock. Operation of the ASTU as the medial zone contingency remedy would prevent further migration of radionuclides to NPTF extraction wells.

During implementation of the contingency remedy, the NPTF would be operated in such a way as to ensure that the concentration of radionuclides in treated effluent would be less than the applicable MCLs. If the medial zone contingency remedy were implemented, a groundwater monitoring program would be established to monitor the migration of radionuclides into the distal zone.

If in the future, cost-effective radionuclide removal technologies become available that could be used for remediation at this site, the Agencies will reassess this component of the amended remedy.

13.7 Development of Alternatives

15. **Topic:** One commenter commended the Agencies for being willing to try something new that could prove to be cheaper and more effective than pump-and-treat technology. The commenter stated that pump-and-treat has been shown over the last 20 years to be a very ineffective way of dealing with non-aqueous liquids. [T1-1]

Response: The Agencies are pleased that members of the public have noted the INEEL's efforts to find, develop, and implement innovative technologies for cleanup, whenever they are appropriate and cost-effective. When pump-and-treat technology was selected in the original 1995 ROD (DOE-ID 1995 [DOE/ID-10139]) for implementation at the hot spot, it was the best technology available. However, at the time the original 1995 ROD was signed, the Agencies realized that better, more cost-effective treatments might be available for the specific cleanup problems identified at TAN. Therefore, the Agencies, through the original 1995 ROD, commissioned treatability studies to identify whether better technologies existed to remediate the contaminant plume. Although better, faster, or more cost-effective technologies were identified for the hot spot and the distal zone of the contaminant plume, pump-and-treat technology continues to be identified as the preferred approach to cleanup of the medial zone of the plume.

13.8 Implementation of Alternatives

16. **Topic:** During the period of remediation, could the TCE revert to gas or vapor form and rise into or through the porous overlying basalt? Would the plume be attenuated in the time frame of 27 or 95 years in this manner? [W2-1]

Response: Only a very small quantity of TCE will revert to vapor or gas, and it will only come from the very thin layer of TCE at the top of the water table. Therefore, very little gaseous phase TCE would be available to rise into the overlying basalt. Vaporization would not be sufficient to attenuate the entire contaminant plume in the specified timeframe. Attenuation will occur through natural degradation of the TCE in the aquifer. Under the selected remedy, the contaminant plume is expected to increase slowly in size until about 2027. At that point, removal of TCE through the three components of the remedy will overtake the plume growth, and the size of the plume will be steadily reduced through the remainder of the remediation time frame (by or before 2095). Results of the studies that determined the effectiveness of the natural attenuation approach were published

in 2000 in "An Evaluation of Aerobic Trichloroethene Attenuation Using First-Order Rate Estimation," by Kent S. Sorenson, Jr., Lance N. Peterson, Robert E. Hinchee, and Roger L. Ely, in *Bioremediation Journal* (a copy of the article is available from the INEEL Community Relations Office).

17. **Topic:** Given the structure of the injection well (depth, diameter, and number and type of openings and their location), which is not specifically described in the Proposed Plan, it is unclear whether the well will serve adequately for injecting the quantity of amendments necessary to carry out in situ bioremediation successfully. Have you thought about this? [W3-2]

    Response: Yes. The structure of the injection well was considered specifically during selection of the remedy. The injection well flow-rates are not known with accuracy due to the lack of historical records. The injection well was completed to a depth of 310 feet with screens in two locations: from 180 to 244 feet, and 269 to 305 feet. This allowed material injected into the well to migrate into the aquifer in two separate zones. Within 50 feet of leaving the well, contaminants migrated to a depth of 400 feet where further downward migration is stopped by an impermeable interbed. During the evaluation of in situ bioremediation, the effect of amendments was monitored to demonstrate that the amendments and the sustained bacterial growth was sufficient to degrade contaminants in the deeper level (down to 400 feet) as well as in the vicinity of the injection well screens (from 180 to 305 feet below land surface). As a result of the in situ bioremediation field demonstration, TCE concentrations are not detectable in groundwater drawn from the injection well or from just above the impermeable interbed (about 400 feet below surface) in Well TAN-26, which is about 50 feet from the hot spot.

    The in situ bioremediation technology allows the amendments to be injected at variable concentrations and at variable flow rates as well as at additional wells near the injection well. During the design phase of this remedial action, the best injection strategy will be determined.

18. **Topic:** The Proposed Plan states that, if a pump-and-treat system were used in the distal zone, off-gas from the system would require treatment before it is released to the atmosphere. TCE concentrations in both the hot spot and the medial zone are higher than the distal zone. Why won't the off-gas be treated when conducting pump-and-treat on either the hot spot or the medial zone? [W5-12]

    Response: The pump-and-treat technology uses air stripping to remove VOCs from contaminated groundwater. In so doing, it transfers the VOCs to air. When this air contains VOCs above legal limits for human health, off-gas treatment (using standard air pollution control equipment, such as carbon beds) is required to remove them from the air before it is emitted from the treatment facility.

    The need for off-gas treatment depends on both the volume of water that must be treated to achieve cleanup goals and the concentration of contaminants in that water. Pump-and-treat at the hot spot and in the medial zone would not require off-gas treatment because of the relatively low processing rates. Pump-and-treat in the distal zone, which is the contingency remedy for MNA, would require off-gas treatment, because a high processing rate would be required due to the large volumes of water needing treatment.

19. **Topic:** Several comments concerned the in situ bioremediation amendments. One commenter asked: What chemicals will be injected during remediation? Of those, which will exceed MCLs when injected? What is the difference between the terms "chemical" and "inorganic" constituents, as used on page 13 of the Proposed Plan? What is the total estimated amount of chemicals that will

be injected? What impact will these chemicals have on the aquifer? At the end of the remediation, will any portion of the plume exceed MCLs for amendment chemicals? If so, how large an area and for how long? [W5-6]

Another comment focused on whether the contaminants in the amendments injected during in situ bioremediation could exceed MCLs. Specifically, is there a potential for lead contamination from sodium lactate amendment? If this is used as the amendment, the commenting group recommends monitoring to ensure that the lead in the lactate will pose no risk. If contaminants in the amendments exceed MCLs, the group recommends that use of the amendment immediately cease and that treatment measures be immediately implemented. [W7-3] The group also recommends that the Agencies (1) develop contingency plans that can be implemented if bioremediation results in increased concentrations of contaminants and (2) search for an alternative amendment that would pose lower risks. [W7-4]

Response: The Agencies expect to select sodium lactate, which is widely used in the preparation of meat and deli products. (Alternatives to sodium lactate continue to be investigated.) Trace quantities of antimony, arsenic, cadmium, chromium, lead, and selenium are present in food-grade sodium lactate at levels above MCLs. These contaminants are present in the lactate as manufacturing impurities. However, data collected during the treatability studies show that the trace contaminants disperse into the aquifer after the sodium lactate is injected. Further information about analysis of bioremediation amendments is available in *Metals Analysis of Selected OU 1-07B Groundwater Monitoring Wells* (INEEL 2000c [INEEL/EXT-2000-00821]), and other documents in the Administrative Record. The term "chemicals" includes inorganic as well as organic compounds. The amount and timing of amendments to be injected will be determined during the remedial design process following signing of this ROD Amendment. The Agencies will modify the amount and timing as necessary during the remedial action to obtain the best results. By or before the end of the remedial timeframe (defined as 2095), the contaminant plume will meet all relevant MCLs.

The monitoring results verified the data obtained from tracer tests: namely, concentrations of trace metals in the groundwater have not increased due to sodium lactate injection. Nevertheless, performance monitoring of bioremediation operations will include analysis of trace metals to ensure continued sodium lactate injection does not adversely affect groundwater quality.

20. **Topic:** One commenter expressed concern that conventional signs and postings would be inadequate for the long term. The commenter stated that permanent markers should be installed on the land surface to alert those who may use this area in the future. The permanent markers should indicate the reason for the posting and where necessary information can be obtained. [W3-3]

Response: The remedial action will restore the entire contaminant plume; thus, permanent markers will not be needed. Signs and postings are one form of institutional controls. Institutional controls include legal access restrictions (such as deed restrictions) and physical access restrictions (such as fencing, signs, and security measures). Institutional controls are used at sites where a cleanup action is not yet completed or cannot be performed, or at any site where the remedial measure leaves contamination in place at levels that could potentially pose a risk to human health or the environment. The effectiveness of the institutional controls will be evaluated as part of the standard CERCLA 5-year review process. These reviews will be conducted by the Agencies no less frequently than every 5 years.

The approach for establishing, implementing, enforcing, and monitoring institutional controls at the INEEL, including WAG 1, is spelled out in Section 8.1.3 of this ROD Amendment.

21. **Topic:** The Proposed Plan states that "the geochemical behavior of the radionuclides in the subsurface acts to bind them to soil and rock.... This will continue to prevent them from migrating beyond the immediate vicinity of the hot spot and from being available to future drinking water users." Are scientific data available to support this? [W5-10]

How can a coefficient be calculated when the basalt has not been sampled for radionuclides? How can one be estimated when the number of curies of each radionuclide disposed of in the well cannot be estimated? [W5-10]

Response: Yes, scientific data available in the Administrative Record for this action, as well as peer-reviewed scientific research literature, support the conclusion that sorption of radionuclides has occurred and will continue to take place. The coefficient and the estimate the commenter mentions cannot be calculated from existing data, nor are they necessary to support the expectation of radionuclide sorption.

Four radionuclides were determined to be contaminants of concern in this cleanup action: tritium, strontium-90, cesium-137, and uranium-234. Of these, strontium-90 and cesium-137 are the only two above MCLs, and they are only above their respective MCLs near the hot spot. The response to Comment No. 10 in this Responsiveness Summary presents more information on the distribution and concentration of all four radionuclides.

Monitoring data collected for over 10 years demonstrate that very strong sorption of cesium-137 and strontium-90 in the source area (hot spot) has acted to limit their migration during the past 40 years. In addition, historical monitoring data reveals that concentrations of cesium-137 drop by an order of magnitude after only 25 feet of travel from the TSF-05 Injection Well, and strontium-90 concentrations drop by two orders of magnitude within 500 feet of the hot spot.

It is known that concentrations of these two contaminants are being and will continue to be reduced through radioactive decay (as measured by standard half-life calculations) and sorption of the radionuclides to the geological matrix through which the aquifer moves. Research data and theoretical models indicate that additional mechanisms, such as carbonate precipitation, also may be operating to reduce radionuclide concentrations. The Agencies expect that concentrations of these radionuclides in the groundwater (dissolved phase) will be below MCLs by 2095 or earlier.

22. **Topic:** Describe the fate and transport of the chlorides liberated by dechlorination of TCE and its daughter products by bacteria. What is the estimated shape and concentration gradient of the chloride plume after remediation? Will some portion of the chloride plume exceed secondary drinking water MCLs? [W5-11]

Response: No, the contaminant concentrations in the plume will not exceed the secondary drinking water MCLs at the end of the restoration time period (by or before 2095). Daughter products (such as vinyl chloride) may be produced as interim, ephemeral breakdown products during ISB activities; however, bioremediation will result in complete dechlorination of VOCs by 2095. Temporary daughter products produced during remediation activities will be short-lived and will not exist at the end of remediation activities. Complete dechlorination of chloroethenes in the aqueous phase in the source area will result in chloride concentrations of less than 5 milligrams per liter (mg/L). Concentrations of chloride in the contaminant plume are 80 to 100 mg/L. The changes expected are so small that they cannot be measured reliably. The remedial action objectives for this ROD Amendment ensure that drinking water standards will be met throughout the plume by or before 2095.

23. **Topic:** How far will tritium migrate from the hot spot, since tritium is expected to move with groundwater in the aquifer? [W5-15]

Response: Tritium is currently below the MCL at all locations within the contaminant plume. The commenter is correct that tritium does move with the groundwater in the aquifer. However, tritium is below MCLs, it has a relatively short half-life (12.5 years), and it will continue to degrade quickly; therefore, there is no possibility that tritium in the contaminant plume will pose a risk to human health or the environment. Tritium in the contaminant plume has migrated to near the current plume boundary (which is based on the migration of TCE). However, the tritium is not expected to migrate much further.

13.9 Evaluation of Alternatives

24. **Topic:** Is off-gas treatment a justification for the preferred alternative of monitored natural attenuation in the distal zone? [W5-12]

Response: The possible need for off-gas treatment (that is, treatment of the air-emission waste stream) under the pump-and-treat alternative is just one of several factors contributing to an implementability ranking of moderate for this alternative, as explained on page 16 of the Proposed Plan. Another implementability factor involved in this ranking is that high pumping rates would have to be maintained because of the large volume of groundwater containing low concentrations of TCE in the distal zone. Short-term effectiveness also received a lower ranking for the original selected remedy in the distal zone, because the pump-and-treat operation could expose equipment operators and site personnel to contaminants when groundwater is brought to the surface. The proposed new remedy of monitored natural attenuation does not present this exposure risk. Finally, the total cost of the original selected pump-and-treat remedy is far higher than the cost of the proposed new remedy of monitored natural attenuation.

25. **Topic:** The text on Page 17 and the information presented in Table 4 are inconsistent. The text states that "[m]onitored natural attenuation does not reduce toxicity, mobility, or volume of contaminants through treatment," but Table 4 ranks that criterion as "moderate." The commenter stated that the criterion should be ranked "Low, least satisfies criterion." [W5-13]

Response: Because MNA will act to attain groundwater restoration without active treatment, its ranking as moderate in Table 4 of the Proposed Plan is not inconsistent with the text quoted. The apparent inconsistency arises because MNA is a naturally occurring process and is not, therefore, a treatment as defined by CERCLA guidance. Under certain circumstances, however, MNA can achieve the clean-up objectives as well as, or better than, an active treatment.

The EPA's CERCLA *Guidance on Preparing Superfund Decision Documents* (EPA 1999c) provides for special groundwater remedies including the use of monitored natural attenuation. According to Appendix B, Section B.4, of the Guidance:

> The 'natural attenuation processes' that are at work in such a remediation approach include a variety of physical, chemical, or biological processes that, under favorable conditions, act without human intervention to reduce the mass, toxicity, mobility, volume, or concentration of contaminants in soil or ground water.

> EPA does not view MNA to be a "no action" remedy. Rather, it is considered AS a means of addressing contamination under a limited set of site circumstances where its use meets the applicable statutory and regulatory requirements.

The Guidance goes on to explain that

> A remedial alternative using natural attenuation as the cleanup method is not the same as the 'no action alternative.' When cleanup is required, natural attenuation may be able to attain cleanup levels in a timeframe that is 'reasonable' when compared to other comparable alternatives.

The Proposed Plan is a "brief summary description" used to facility public involvement. As a summary, the Proposed Plan was not able to discuss in detail the monitored natural attenuation evaluation, but referred the reader to the Field Demonstration Report (DOE-ID 2000 [DOE/ID-10718]) and other documents in the Administrative Record in which this information was provided.

The technology evaluation conducted for monitored natural attenuation demonstrated that trichloroethene (TCE) was being degraded under natural aquifer conditions. The evidence for this is quite strong and is based on a comparison of TCE against both tritium (corrected for radioactive decay) and tetrachloroethene (PCE), two compounds that can be treated as conservative tracers. The concentration of TCE decreases relative to the two tracers. This can be used to estimate a degradation half-life of 10 to 20 years. The monitored natural attenuation remedy is designed to monitor this process as it occurs in the future. A new monitoring network has been installed to measure the performance of the natural attenuation process. The Proposed Plan is a summary document that is not intended to present the technical details of the evaluation. The details are preserved in the Administrative Record and are available for public review.

26. **Topic:** Page 18 of the Proposed Plan concludes that the proposed remedies will "restore the entire contaminant plume." Since this applies only to solvent compounds, not to radionuclides, isn't this an incomplete and misleading statement? [W5-14]

Response: No, the statement is correct and complete. Restoration of the contaminant plume will be achieved by meeting the remedial action objectives (see page 11 of the Proposed Plan and Section 5.2 of this ROD Amendment). The remedial action objectives apply to all contaminants of concern, including radionuclides. The Agencies expect that radionuclides in the groundwater (dissolved phase) will be below MCLs, thereby ensuring a drinking water supply for future consumers that meets state and federal water quality standards. The five-year review process will play an integral role in the remedial action to monitor the pace of progress toward the objectives. If it becomes clear that meeting the objectives is in doubt using the proposed remedy, additional remedial actions will be taken to ensure protectiveness.

The selected remedy utilizes technologies that are fully expected to meet the remedial action objectives within the action time frame. Many detailed analyses of fate and transport models for radionuclides in this contaminant plume have been carried out. Details and primary data are available in the multiple sources in the Administrative Record. Much of this research, which utilizes current technologies and scientific models, is also published in scientific journals and presented at international conferences on environmental remediation.

The Agencies are confident that the combination of technologies that have been selected for restoration of the contaminant plume will protect human health and the environment at lower cost, and with less waste generated, than the original remedy.

27. **Topic:** Several commenters supported the Agencies' preferred alternative for remediation of Operable Unit 1-07B. [W1-1, W3-4, W4-1, W6-1] One commenter called it very encouraging to see the triumph of science and logic. [W1-2] Several commenters lauded the Agencies for finding a more cost-effective solution. One commenter suggested that the total cost savings will be far greater than the $7 million indicated in the Proposed Plan. [W1-2] A commenting group supported the Proposed Plan, stating that the Agencies have applied good science and technology in arriving at this proposed and cost-effective solution to a problem, with wide future applicability to national and worldwide sites. [W6-1] Another commenting group said that the new remedy appears to be both economically and environmentally preferred over current reliance solely on pump-and-treat. They applauded the successful demonstration of the value of expenditures on research and development. The group recommended that the process of identifying and demonstrating emerging technologies with potential merit serve as a model for future efforts. The group was particularly excited that successful demonstration of in situ bioremediation may have widespread applications. [W7-2]

Response: The preferred alternative will effectively protect human health and the environment from the risks posed by TCE and the other contaminants of concern. In addition, the alternative has very high cost-effectiveness. In developing alternatives, CERCLA guidance (EPA 1999c) expresses a preference for the development of innovative treatment technologies if they offer the potential for superior treatment performance or implementability, fewer adverse impacts than other available approaches, or lower costs for similar levels of performance than demonstrated technologies.

28. **Topic:** Insufficient statistical data were presented in the Proposed Plan for the commenter to be able to evaluate the in situ bioremediation alternative. [T3-2]

Response: The Proposed Plan is a summary only, containing information required for the public to review the alternatives and preferences under consideration. The reasons behind this format were developed by the EPA in its guidance for CERCLA documents (EPA 1999c), and are described in the response to Comments 4 and 5 in Section 13.3 of this summary. The Proposed Plan provided references to the relevant sections of the 1994 comprehensive RI/FS (EG&G 1994 [EGG-ER-10643]) and the Field Demonstration Report (DOE-ID 2000 [DOE/ID-10718]), and other documents in the Administrative Record that present in full the information from which the Proposed Plan is derived. The complete details of the OU 1-07B investigation, including sampling data, maximum contaminant levels (MCLs), and well construction details, can be found in the RI/FS, the Field Demonstration Report, and other OU 1-07B documents in the Administrative Record.

The information the commenter requested is in the RI/FS, which is part of the Administrative Record. Instructions for accessing the Administrative Record are provided in the Proposed Plan. The public may also attend public meetings or request briefings to get more details about the alternatives and other data summarized in the Proposed Plan.